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Idaho Operations Office

INEEL CERCLA Disposal Facility – Master Table of Documents (60% Design Components)

Idaho National Engineering and Environmental Laboratory

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ABSTRACT

This document is the umbrella document for the submittal of several studies documenting the 60% design of various components for the design/construction of the INEEL CERCLA Disposal Facility. This document provides brief background on the INEEL CERCLA Disposal Facility project. It also includes abstracts of all documents that are part of this submittal. Appendices of Agency comments and subsequent responses are also included.

The documents and drawings included in this submittal address key issues that were identified during the 30% design review. The intent is for the documents to be incorporated, as appropriate, into the Remedial Design/Remedial Action Work Plan for the INEEL CERCLA Disposal Facility.

CONTENTS

ACRONYMS

AOC	area of contamination
ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	Department of Energy
DOE-ID	U.S. Department of Energy Idaho Operations Office
EDF	Engineering Design File
ICDF	INEEL CERCLA Disposal Facility
IDAPA	Idaho Administrative Procedures Act
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
MCL	maximum contaminant level
NESHAP	National Emission Standard for Hazardous Air Pollutants
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
RI/BRA	remedial investigation/baseline risk assessment
ROD	Record of Decision
SSSTF	Staging, Storage, Sizing, and Treatment Facility
TSCA	Toxic Substances Control Act
WAC	Waste Acceptance Criteria
WAG	waste area group

INEEL CERCLA Disposal Facility – Master Table of Documents (60% Design Components)

1. INTRODUCTION

This introduction gives brief background information on the INEEL CERCLA Disposal Facility (ICDF) project and describes the organization of this design submittal.

1.1 Background

The Idaho National Engineering and Environmental Laboratory (INEEL), including the Idaho Nuclear Technology and Engineering Center (INTEC), was placed on the National Priorities List in November 1989. A *Federal Facility Agreement and Consent Order* (DOE-ID 1991) was negotiated among the Department of Energy (DOE), U. S. Environmental Protection Agency, and Idaho Department of Health and Welfare to direct Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup activities at the INEEL.

A comprehensive study, or remedial investigation/baseline risk assessment (RI/BRA) (DOE-ID 1997), was conducted to evaluate the nature and extent of soil and groundwater contamination at the INTEC. The results of the RI/BRA activities indicate that soil at certain release sites and groundwater contamination pose a potential risk above acceptable levels to human health and the environment. Therefore, the U.S. Department of Energy Idaho Operations Office (DOE-ID) authorized a remedial design/remedial action for the INTEC, resulting in the *Final Record of Decision, Operable Unit 3-13* (ROD) (DOE-ID 1999).

The ROD states that CERCLA-generated wastes from within the INEEL boundaries will be removed and disposed in a new facility, the ICDF. The ICDF Complex has two major components: (1) the disposal (landfill) cells, which are referred to as the ICDF (the ICDF includes the evaporation ponds and leachate collection system), and (2) the Staging, Storage, Sizing, and Treatment Facility (SSSTF). The ICDF Complex will be within the boundaries of the Operable Unit 3-13 area of contamination (AOC). The ICDF Complex will be for treatment and disposal of low-level, hazardous, mixed, and some Toxic Substances Control Act (TSCA) wastes. The ICDF Complex combines the SSSTF and the ICDF and necessary subsystems and support facilities to provide a complete waste disposal system.

The ICDF landfill cell(s) has an authorized capacity of approximately 390,000 m^3 (510,000 yd^3). The evaporation pond will provide treatment/disposal capability for CERCLA-generated aqueous wastes. The ICDF landfill can have multiple cells and will be closed with a DOE Order 435.1/Resource Conservation and Recovery Act (RCRA) -compliant cover. Each disposal cell will be engineered to meet DOE Order 435.1, RCRA (40 CFR 264), Idaho Hazardous Waste Management Act (IDAPA 58.01.05), and TSCA polychlorinated biphenyl (PCB) landfill design and construction requirements (40 CFR 761).

A conceptual design for the ICDF (DOE-ID 2000a) was developed. The conceptual design consisted of the following physical items:

- A low-level, hazardous, mixed waste landfill that will provide waste disposal capacity for INEEL CERCLA-generated wastes

- An evaporation pond that will provide treatment/disposal capability for CERCLA-generated aqueous wastes, ICDF landfill leachate and storm water runoff, and process effluent from the SSSTF

- A leachate collection system that will transfer leachate from the landfill to the evaporation pond and provide leak detection

- A landfill cap that will minimize infiltration and prevent access to wastes underneath

- Utilities, road modifications, and other site modifications necessary to support the project.

Following the conceptual design, a performance specification was written, which addresses the details required in order for a subcontractor to furnish

> …all labor, supervision, materials, supplies, tools, equipment, facilities, technical and professional services, quality control, testing, and documentation required to perform design, planning, procurement, construction, system acceptance testing, and performance of all the operations necessary and required for successful and on-time design and construction of the ICDF at the U.S Department of Energy (DOE) INEEL in accordance with the design documents…. (SPC-332)

With the completion of the conceptual design and the performance specification, a request for proposal was issued and, on January 9, 2001, a subcontract was awarded to CH2M Hill to design and construct the ICDF. The major project milestones include

1. Submit Title I (30%) design to Agencies by April 24, 2001

2. Submit Title II (90%) design for Agencies' review by December 19, 2001

3. Have the ICDF operational by May 2003.

1.2 Organization of Design Submittal

This submittal for ICDF design is made in one volume. This package, submitted under "INEEL CERCLA Disposal Facility – Master Table of Documents (60% Design Components)," includes the current design information for the various components of ICDF, as requested by the regulatory Agencies. Specific documents included in this 60% design are a screening-level ecological risk assessment, waste acceptance criteria for the landfill and evaporation pond, modeling for the final cover and for fate and transport, decision analysis for the permeable reactive barrier, equivalency analysis for the evaporation pond liner, construction QA plan, a National Emission Standard for Hazardous Air Pollutants (NESHAP) report, waste placement mapping, and evaporation pond berm overtopping analysis. The individual documents in this package will continue to evolve through the completion of Title II, as appropriate.

This document includes a listing of all items provided as the package (Section 2). Summary information in Section 2 briefly discusses each document. References are included as Section 3. Appendixes present detailed figures showing the sequence of the Cell 2 liner system interface with Cell 1 (Appendix A), general operation flow diagrams and summary text for the ICDF landfill and evaporation pond (Appendix B), and monitoring data quality objectives (Appendix C). Appendices D and E are, respectively, EPA and IDEQ comments/resolutions.

1.3 Purpose of the Submittal

The purpose of this submittal is to provide information on the design of the ICDF. The 60% design submittal is in response to the 30% design review, which identified several issues associated with the ICDF. The design information supplied here will be the basis for the Title II submittal. The information was first provided as a draft to give the Agencies the opportunity to review and comment. This final 60% design addresses these comments to complete the 60% design submittal (see Appendices D and E).

2. DESIGN DOCUMENTS AND DRAWINGS FOR THE 60% SUBMITTAL

This section provides an abstract for each document included in the ICDF 60% design submittal. This summary information is presented with the same organization as the full submittal, that is, the order of the documents is identical to the full submittal.

INEEL CERCLA Disposal Facility – Master Table of Documents (60% Design Components), DOE/ID-10925

This document is the umbrella document for the 60% design submittal for design/construction of the ICDF. This document gives brief background on the ICDF project and describes the organization of the 60% design submittal. It also includes brief summary information describing each document. Appendixes present detailed figures showing the sequence of the Cell 2 liner system interface with Cell 1 (Appendix A), general operation flow diagrams and summary text for the ICDF landfill and evaporation pond (Appendix B), and monitoring data quality objectives (Appendix C).

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Screening Level Ecological Risk Assessment for the ICDF (60% Design Component), EDF-ER 311

This file presents the results of the screening of contaminants that was performed to better project ecological risk that might result from operation of the planned ICDF. The contaminants considered and their projected concentrations are derived from the design inventory (EDF-ER-264) and the CERCLA Waste Inventory Disposal (DOE-ID 2000b). The screening was based initially on ecologically-based screening levels and finally on hazard quotients and hazard indicies.

Waste Acceptance Criteria for ICDF Landfill (60% Design Component), DOE/ID-10865

The ICDFy landfill will accept CERCLA wastes generated within the INEEL. Hazardous, mixed, low-level, and TSCA (polychlorinated byphenyls) wastes will be accepted for disposal at the ICDF landfill. The purpose of this Waste Acceptance Criteria document is to provide the basis for the quantities of radioactive and nonradioactive wastes allowable in waste designated for disposal in the ICDF landfill.

The ICDF Complex Waste Acceptance Criteria is the master Waste Acceptance Criteria. As such, the details of compliance that are the same for all areas of the ICDF Complex are referenced to that document. This ICDF landfill Waste Acceptance Criteria specifies the chemical and radiological waste acceptance criteria for wastes that will be disposed to the landfill. Compliance with the requirements of this ICDF landfill Waste Acceptance Criteria will ensure protection of human health and the environment, including the Snake River Plain Aquifer. Wastes placed in the ICDF landfill must not cause groundwater in the Snake River Plain Aquifer to exceed either maximum contaminant levels a hazard index of 1, or 10^{-4} cumulative risk levels.

Waste Acceptance Criteria for ICDF Evaporation Pond (60% Design Component), DOE/ID-10866

The ICDF evaporation pond will accept CERCLA wastes generated within the WAG 3 area of contamination and other INEEL WAG area of contamination boundaries. Hazardous, mixed, and low-level, wastes will be accepted for disposal at the ICDF evaporation pond. The purpose of this Waste Acceptance Criteria document is to provide the basis for the quantities of radioactive and nonradioactive wastes allowable in waste designated for disposal in the ICDF evaporation pond.

The evaporation pond is designated as a Corrective Action Management Unit in accordance with the substantive requirements of IDAPA 58.01.05.008 (40 CFR 264.552) and designed to meet 40 CFR 264 Subpart K and CC for the purpose of managing ICDF landfill leachate and other aqueous wastes generated as a result of operating the ICDF Complex (DOE-ID 1999).

The ICDF Complex Waste Acceptance Criteria is the master document for all waste coming into the ICDF Complex. The purpose of this evaporation pond Waste Acceptance Criteria is to provide the basis for the quantities of radioactive and nonradioactive contaminants that may be present in the aqueous wastes disposed in the ICDF evaporation pond and the basis for its operation. The aqueous wastes will include leachate from the ICDF landfill, purge and development water from monitoring well drilling operations, secondary aqueous wastes generated from waste processing and decontamination activities in the SSSTF, and other INEEL CERCLA projects.

Compliance with the requirements of the evaporation pond Waste Acceptance Criteria will ensure protection of human health and the environment. This document defines responsibilities, identifies the waste acceptance process, and provides the regulatory citations used in the development of the evaporation pond aqueous Waste Acceptance Criteria, and the acceptable numerical concentrations for the waste constituents.

Hydrologic Modeling of Final Cover (60% Design Component), EDF-ER-279

The long-term infiltration rates through the proposed landfill cover section for the ICDF were estimated to determine percolation from the base of the cover. Hydrologic modeling was conducted to simulate extreme climatic scenarios that could result in infiltration through the cover. Climatic parameters used during hydrologic modeling were based on site data from 10 years representing average conditions (1967 to 1976) followed by four years with precipitation greater than the 90th percentile of recorded annual precipitation (1957, 1963, 1964, and 1995) to represent an extreme climatic scenario. The modeling effort evaluated the performance of the cover by determining surface runoff, infiltration through the upper soil component of the cover system, lateral drainage, and cover defects. The performance of the soil cover was evaluated based on the water flux at a node located at the base of the ICDF landfill cover. Sensitivity analyses were performed to determine the optimum water storage layer thickness and upper precipitation bound.

Fate and Transport Modeling Results and Summary Report (60% Design Component), EDF-ER-275

This report describes the fate and transport modeling conducted to establish remedial action objective-based waste soil concentrations for design basis contaminants intended for disposal at the ICDF. The modeling results provide contaminant travel time and concentration at the point of compliance. The results are intended to provide guidelines for determining preliminary Waste Acceptance Criteria for the ICDF list of potential contaminants of concern, and to evaluate design performance requirements of the ICDF cover barrier.

Permeable Reactive Barrier Decision Analysis (60% Design Component), EDF-ER-273

This study is based on the results of the Leachate Contaminant Reduction Time Study, Hydrologic Modeling of the Final Cover, Liner/Leachate Compatibility Study, and the Fate and Transport Modeling Results and Summary Report (compiled in DOE-ID 2001). The results summarized herein also reflect the results of these studies at the 30% and 60% stage, with an understanding that further refinement of the fate and transport modeling and leachate reduction study will occur between the 60% and 90% design deliverables.

The studies performed in support of the ICDF Title I Design indicated that a permeable reactive barrier is not effective in protecting human health and the environment from long-lived mobile radiological contaminants leaching from the ICDF. Of the materials available for a permeable reactive barrier, none effectively immobilize the migration of contaminants, although some minimally retard migration. Proposed permeable reactive barrier materials that have the capability of reducing mobility of I-129 are peat and activated carbon, but the life expectancy of these reactive materials is not expected to meet the 1,000-year design life of the facility, because of their capacity to react with a large variety of chemicals in addition to the contaminants of concern.

Modeling has demonstrated that an infiltration-reducing cover is more protective of the Snake River Plain Aquifer. Such an infiltration reduction cover that takes advantage of the local climatic conditions is included as part of the design and will be installed with appropriate layers to protect the soil cover portion of the cover from erosion for 1,000 years or longer. As a component of the ICDF design, the low-infiltration cover will be more reliable than an experimental permeable reactive barrier.

This analysis concludes that the use of an infiltration-reducing cover design will be more effective than the use of a permeable reactive barrier in protecting the Snake River Plain Aquifer from migration of landfill contaminants for the design life of the ICDF landfill. The use of a permeable reactive barrier will not increase protection of human health or the environment.

Evaporation Pond Lining System Equivalency Analysis (60% Design Component), EDF-ER-312

A lining system designed to the requirements of RCRA Subtitle C (40 CFR 264.221) was developed for the evaporation pond. In addition to the Subtitle C design requirements, a 3-ft-thick soil operations layer was provided to allow the standard design to meet the performance specifications for the operation environment (temperature extremes) of the evaporation pond lining system. The operations layer added a design element (i.e., waste generation) not desirable to the operation of the evaporation pond. In order to accommodate these operational conditions, while minimizing waste generation due to periodic replacement of the operations layer, an alternative design is proposed for approval by the regulatory agencies.

The evaporation pond lining system equivalency analysis provides a demonstration that the proposed alternative evaporation pond lining system will function at least as effectively as the standard Subtitle C lining system. Criteria to demonstrate equivalency are two-fold: (1) prevent migration of any hazardous constituents into the groundwater or surface water at least as effectively as the standard lining system; and (2) allow leak detection through the top liner at least as effectively as the standard lining system. In addition to the broad criteria cited in the regulations, additional relevant technical equivalency criteria developed from project experience and the literature are presented and discussed.

INEEL CERCLA Disposal Facility Construction Quality Assurance Plan for Phase 2 Construction (60% Design Component), DOE/ID-10851

This plan describes the construction quality assurance responsibilities and procedures for work anticipated during Phase 2 construction for the ICDF. This shall include construction of the liner, leachate collection piping, and operation layer for cell 1 and the evaporation ponds. This Construction Quality Assurance Plan is prepared as a stand-alone document to be implemented by an independent, third-party construction quality assurance certifying officer.

ICDF Complex NESHAP Modeling (60% Design Component), EDF-ER-290

Compliance with NESHAP regulations is an applicable or relevant and appropriate requirement (ARAR) for the ICDF Complex. This Engineering Design File (EDF) presents the modeling methodology employed and the results of that modeling.

The INEEL Site boundary was used as the location where the maximally exposed individual (MEI) of the public is located. The radioactive dose from the normal operation of the landfill and the evaporation pond was calculated at this location. The dose was based on the data provided in EDF-ER-264.

The dose from the landfill operation assumed that the maximum yearly activity entering the landfill would be 36% of the total inventory. The dose from the evaporation pond estimated the radioactivity in the leachate that is discharged into the pond. Leachate activity is maximized by assuming it comes from the full landfill. The remaining particulate radionuclides released used a resuspension factor of 1×10^{-3}. This is the same factor used in 40 CFR 61, Appendix D, for activity in liquids and particulate entering the air.

Results of the modeling, as presented below in Table 1, indicate that air emissions from the landfill and the evaporation pond are below levels of concern.

Table 1. Estimated dose at the INEEL boundary from the operation of the landfill and evaporation pond.

Facility	Dose (mrem/yr)	Major Radionuclide Contribution to Dose (percentage)	
Landfill operation	4.59×10^{-2}	^{129}I –96.6%	^{137}Cs –1.3%
Evaporation pond	5.33×10^{-4}	^{90}Sr –86.0%	^{238}Pu –5.8%
Total dose	4.64×10^{-2}	^{129}I –95.5%	^{137}Cs –1.3% ^{90}Sr –1.8%

Results from this modeling will be used to supply information for the ICDF landfill and evaporation pond Waste Acceptance Criteria.

Waste Placement Mapping Plan (60% Design Component), EDF-ER-322

This plan evaluates and provides a recommendation regarding how wastes will be mapped and tracked during placement in the ICDF landfill. The plan evaluates two alternative tracking methods currently used at other DOE sites and provides additional information regarding the recommended approach for tracking wastes.

Evaporation Pond Berm Overtopping Analysis (60% Design Component), EDF-ER-323

This EDF contains the ICDF engineering calculation for berm overtopping analysis from wind setup and wave runup.

This analysis discusses the procedures and findings for the analysis of wind setup, wave generation, and wave runup in the east and west evaporation ponds of the ICDF at the INEEL in southern Idaho.

3. REFERENCES

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40 CFR 264 Subpart K, 1982, "Surface Impoundments," *Code of Federal Regulations*, Office of the Federal Register, July 1982.

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40 CFR 761, 2000, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," *Code of Federal Regulations*, Office of the Federal Register, July 1999.

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